GROUNDWATER QUALITY

Groundwater Use In Kentucky

Approximately 5.2 percent of the total estimated water use of 4800 million gallons per day (mgd) comes from groundwater sources in Kentucky (see table 20). It must be noted however, that over 83 percent of the total water used goes toward self-supplied thermoelectric power generation with a very low percentage (3.5%) being consumed. A more realisitic appreciation of groundwater use can be observed by examining total water use for both public and rural supplies. In this regard, groundwater accounts for over 13 percent of the total water use for public supplies and 90 percent for rural domestic supplies. The importance of this resource is underscored in the rural areas since nearly all the drinking water is derived from groundwater. This is primarily because surface water supplies are either inadequate, undependable (during droughts) or too contaminated for treatment by small communities or the individual homeowner.

Table 20

State Summary of Groundwater Use for 1980[1]

User Category	Water Use (mgd)[2]	Total Groundwater Use (mgd)	Percent Groundwater of Total Water Use Within User Category	Consumptive Use (mgd)
Public Supplies	360.0	47.0	13.1	23.0
Rural Supplies				87.0
Domestic Use	60.0	54.0	90.0	
Livestock Use	39.0	1.9	4.9	
Irrigation Use	4.9	0.2	4.1	4.9
Self-Supplied Industrial Use	320.0	130.0	40.6	33.0
Self-Supplied Thermoelectric Power	4000.0	15.0	0.4	140.0
Statewide Total[3]	4800.0	250.0	5.2	290.0

1. Adapted from Solley, Chase, Mann, 1983. "Estimated Use of Water in the United States in 1980" U.S. Geological Survey Circular 1001.
2. mgd = million gallons per day
3. Does not include water withdrawn for hydroelectric power

Current State Groundwater-Related Legislation and Regulations

At this time, no one state agency has responsibility for a comprehensive groundwater management program. Groundwater is addressed as a component of many solid and hazardous waste, mining and surface water acts. As a result of this fragmentation of legislation, management and protection of this resource is difficult. Specific state acts relating to groundwater protection and/or management that the Cabinet implements include:

- Kentucky Environmental Protection Law (Kentucky Revised Statutes, Chapter 224 - Environmental Protection, 1968 as Amended).
- Kentucky Water Quality Standards (Kentucky Administrative Regulations, Title 401, Chapter 5, December 1979).
- Kentucky Water Withdrawal Law (Kentucky Revised Statutes, Chapter 151 Environmental Protection 1966 as Amended).
- Control of Water Pollution from Oil and Gas Facilities (401 Kentucky Administrative Regulations, 5:090, 1983).
- Kentucky Permanent Program Regulations for Surface Coal Mining and Reclamation Operations and Coal Exploration Operations (405 Kentucky Administrative Regulations, Chapters 7 through 24, December 1983).
- Kentucky Waste Management Regulations (401 Kentucky Administrative Regulations Chapters 34 and 35, December 1983, as Amended).
- Kentucky Mineral Conservation and Development Statutes (Kentucky Revised Statutes 353.010-353.991 (Oil and Gas Conservation).

Groundwater Monitoring Efforts

Division of Water - Water Quality Management Program

A major investigation of nonpoint source problems associated with karst aquifer systems is currently in progress in Bowling Green, which is one of the largest cities in the United States located upon a karst landscape. The aquifers of this region are generally composed of horizontal carbonate rocks and regolith deposit. Groundwater occurs primarily in solution-enlarged bedding planes and to a lesser extent in enlarged joints and faults. The extensive karst areas are more vulnerable to groundwater contamination than other geologic areas because of direct conduits provided by sinkholes, sinking streams, and major springs.

Groundwater problems have been especially noticeable in the Bowling Green area because of the combination of karst geology, urbanization-induced flashy response to storm events, and the high density of septic tanks and drain fields (with low to non-existent soil attenuation rates). All these factors contribute toward high fecal coliform, nutrient and heavy metal concentrations in the groundwater. These parameters are currently being monitored within the context of the state's 208 Water Quality Management Program (in accordance with P.L. 92-500 as amended by the Clean Water Act of 1977).

The monitoring stations are located throughout the Lost River Drainage Basin which include portions of downtown Bowling Green (septic tank effluent, faulty sanitary sewers, storm drains) and agricultural areas (row crops, livestock runoff). The stations monitor permanent and intermittent surface and subsurface streams, groundwater aquifers, and local weather conditions for future management of nonpoint source pollution within karst topography.

Flow

The average discharge for the period of record (56 years) is 2,486 cfs for the Levisa Fork at Paintsville (River Mile Index 65.2). Mean discharge for water year 1982 was below the annual average discharge (-15%). During water year 1983, the mean discharge was 12% below the annual average. The concentration effect of flow reduction during the reporting period was a contributing factor to observed increases in certain physicochemical parameters.

Hydrologic Unit 05070201 - Tug Fork

A total of 288 miles of streams draining 1,559 square miles (476 square miles in Kentucky) comprise this hydrologic unit. The major urban center (in Kentucky) is Inez (pop. 469). Two water quality monitoring stations are located in this hydrologic unit: Tug Fork at Kermit and Tug Fork at state line.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 5.2 to a maximum of 12.3 with a mean range of 8.3 to 8.6 and a median range of 8.4 to 8.5.

o pH

For the reporting period pH ranged from a minimum of 6.7 to a maximum of 8.5 with a mean range of 7.5 to 7.8 and a median range of 7.6 to 7.9. For the period of record (1979-1983) pH ranged from a minimum of 6.7 to a maximum of 8.5 with a mean range of 7.6 to 7.9 and a median range of 7.7 to 7.9.

o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 1.2 to a maximum of 48.8 with a mean range of 4.8 to 16.0 and a median range of 5.8 to 6.2. For the period of record (1979-1983) acidity ranged from a minimum of 0.0 to a maximum of 48.8 with a mean range of 4.3 to 9.9 and a median range of 4.0 to 4.2.

o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 48.8 to a maximum of 269.0 with a mean range of 107.8 to 142.8 and a median range of 107.0 to 120.6. For the period of record (1979-1983) alkalinity ranged from a minimum of 15.6 to a maximum of 269.0 with a mean range of 105.7 to 127.8 and a median range of 106.0 to 113.0.

o Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 228.0 to a maximum of 922.0 with a mean range of 482.8 to 495.9 and a median range of 442.0 to 527.0. For the period of record (1979-1983) conductivity ranged from a minimum of 197.0 to a maximum of 923.0 with a mean range of 465.5 to 478.4 and a median range of 432.0 to 433.0.

The bulk of current USGS-KGS groundwater efforts is on the collection and compilation of continuously recorded and periodically measured groundwater level data from a permanent observation well network throughout the Commonwealth. Approximately one-third of these wells are in the Louisville area where rising groundwater levels are a major concern. These data reflect natural or artificial changes in groundwater storage and are published annually by the USGS as a part of "Water Resources Data" for the state.

The USGS also maintains observation wells at the Maxey Flats Radioactive Waste Burial site in Fleming County. Both water levels and radionuclides are monitored. Hydrogeologic studies of the site indicate that low-level radionuclides have moved laterally through fractured rock as much as 270 feet from the nearest burial trench.

A major baseline monitoring effort is also being proposed for the Kentucky River Basin. In addition to examining the basic resource, efforts will be directed toward the cause-effect relationship between such water impacting activities as coal extraction and oil and gas production, and ground and surface water quality and quantity. Major domestic water supply wells will be tested for certain parameters in selected areas. At this time, preliminary discussions have been carried out between KGS and other state agencies to determine the compatibility of the proposed monitoring effort with past, present and future surface water studies.

Future Groundwater Programs

Water Well Driller Certification Program

Recent legislation which will provide a new section of law creating a water well driller certification program, was passed by the 1984 Kentucky General Assembly. The bill was introduced as part of the recommendations of the Water Management Task Force, a study group created by the 1982 legislature. The features of the legislation include:

- o requiring all water well drillers of "commercially constructed wells" to be certified,
- o establishing a board of certification,
- o outlining the powers of the board,
- o defining the powers and responsibilities of the Natural Resources and Environmental Protection Cabinet related to the certification program,
- o providing minimum requirements for obtaining certification,
- o establishing penalties for violation, and
- o requiring water testing for fecal coliform and initial disinfection.

Underground Injection Control

The U.S. Environmental Protection Agency plans to implement the Underground Injection Control (UIC) program for Kentucky by May of 1984 for well classes I through V. Proposed UIC regulations were submitted to the state from EPA for their review in late 1983. The state's Department for Mines and Minerals, Division of Oil and Gas, plans to seek primacy for Class II wells, which are used to dispose of oil and gas drilling brines and to pump fluids (steam, solvents, etc.) for the enhanced recovery of petroleum products. Kentucky primacy of Class II wells, including any associated

monitoring and enforcement requirements, is not expected to take place before the winter of 1984 or spring of 1985.

Groundwater Contamination And Depletion Incidents In Kentucky

Kentucky does not have summary data on groundwater contamination problems because field investigations are generally not conducted due to limited funds, unless the condition is extremely serious. A number of groundwater contamination incidents in the Commonwealth during the past couple of years have involved various state agencies. Included as examples are six such incidents which occurred in Jefferson, Magoffin, Harlan, Warren, Knott, Floyd, and Meade counties. In addition, a short description of the depletion and contamination problem that is occurring throughout the Eastern Coalfield is also presented.

Mill Creek Area, Jefferson County

Most of Jefferson County's water supply needs are met by the Louisville Water Company (LWC). At present, the Ohio River is the sole source of raw water for the LWC which serves most of the Mill Creek area. Currently, no water utility uses the area's groundwater for public water supply. However, between 300-600 Mill Creek residents depend upon private water wells (groundwater) for domestic use due to the absence of nearby water mains.

The 1974 Water Quality Management Plan (201 Plan) for Metropolitan Louisville recommended that the Mill Creek area in SE Jefferson County be served by a regional sewerage system. The system would relieve almost all (20,000) existing septic tank-seepage pit systems and 18 of the 26 package wastewater treatment plants.

In the early 1980's, EPA prepared an Environmental Impact Statement (EIS) of the 201 study area. The EIS groundwater assessment involved an evaluation of area groundwater quality and concluded that because of some high nitrate and bacteria levels, area groundwater was not suitable as an untreated drinking water source. The source of the contamination is presumed to originate from the faulty septic systems and package treatment plants. It is expected that the contamination conditions would persist for several years, regardless of which sewering alternative is selected, due to the time necessary to construct facilities.

Because of the existing questionable suitability of the aquifer as an untreated drinking water source, EPA encourages local agencies to extend public water service to those Mill Creek residences not now served. In the cases where service cannot be extended, a groundwater quality monitoring program could include special emphasis on monitoring areas that would rely on groundwater for private water supply. Under any circumstances, private water supply users have been encouraged by EPA to disinfect area groundwater prior to consumption; families with infants have been instructed to contact the Health Department to determine if nitrates are a concern in their water.

Magoffin County

Water wells at about 200 households in the northeastern third of Magoffin County have been polluted by oil brines since oil-drilling increased in June of 1980. About 500 other households in rural portions of the county already had water-quality problems prior to the current oil boom according to Donald Crownover, Chairperson of the Salyersville Water Commission.

The most likely source of the pollution, according to some experts, is brine runoff into local springs. Oil recovered in the eastern Kentucky oil fields usually is mixed with brine water from oil-bearing strata below. Oil companies separate the oil from the brine and often place the brine into open evaporation pits. Unfortunately, precipitation and runoff exceed evaporation in the state, resulting in overflow into surface and groundwaters. Brine may also be absorbed by highly permeable soil and enter the water supply.

Salyersville, which provides 750 households with treated water, agreed to make 800 gallons of water a day available for distribution to affected rural residents. Governor Brown authorized the use of state disaster funds and members of the Kentucky National Guard to distribute the water if the weather made travel difficult during the winter of 1982-1983. The Division of Water expects that in the future, the newly promulgated Oil and Gas regulations will significantly reduce incidents of this nature.

Bowling Green, Warren County

In addition to the nonpoint source problems associated with karst topography described elsewhere in this section, there have been a number of other groundwater contamination incidents in the Bowling Green-Warren County area. One nonpoint source contaminant of great concern is gasoline from leaking storage tanks. On more than one occasion, gasoline fumes have seeped into area residential basements forcing occupants to evacuate. Combustible fumes were suspected of causing the simultaneous explosion of two area houses a number of years ago. Unfortunately, a heavy petroleum smell is becoming more commonplace throughout the cave system especially downgradient from the industrial park area. More recently, residents in the vicinity of a nearby cave entrance complained of fumes being sucked into their apartment by their air conditioning units.

Point source pollution, however, is also a severe problem. A high density of waste generators exists in the Bowling Green area with a great diversity of wastes produced. There are approximately 40 area industries and their associated potential contaminants include everything from domestic wastes to heavy metals to complex synthetic organic compounds. Some industries have their own treatment facilities and others rely on commercial waste haulers to truck by-products (sludge, spent solvents, etc.) off the site. Unfortunately, because of containment leakage, sloppy practices (spillage) and/or intentional discharge into sinkholes, some groundwater contamination by industrial by-products has occurred.

Typical contaminants previously detected in grab samples from the subterranean waters in the area include substances such as total cyanide, lead, cadmium, chromium, copper, iron, nickel, zinc, and arsenic. Detectable levels have been in the range of 0.001-0.10 mg/l. Determining the magnitude of contamination is difficult because some natural deposits of the above substances appear to exist in the Bowling Green drainage basin. Conversely, volatile organics have been detected at levels between 1-100 ug/l. These include compounds such as benzene, xylene, methylene chloride, 1,2-dichloroethane, carbon tetrachloride, bromodichloromethane, and 1,1,2-trichloroethylene which are known carcinogens. Locating specific sources of these contaminants has been difficult because of the nature of the underground streams and karst geology in the Bowling Green area.

The Division of Water expects that some of the objectives of the groundwater monitoring efforts conducted as part of the state's 208 Water Quality Management Program (described previously in this section) will provide at least some solutions to this problem. In particular, applicable objectives include a determination of the:

1. locations, pathways or conduits of major underground streams;
2. effectiveness of natural cleansing of underground streams as compared to surface waters in terms of absorption, filtration, time-related decay or natural die-off, oxygenaton and dilution;
3. relationship between volume, velocity, stream morphology, and pollutant assimilative capacity of underground streams;
4. quality and interrelationships between water in storage (slow moving water) in limestone as compared to water in rapid transit (underground streams) in terms of pollution and use impairment of the entire aquifer within the study area;
5. extent to which minimum criteria associated with use classifications for surface waters might differ from criteria for subterranean waters due to significantly different environmental conditions; and
6. quantitative level of pollution that can be allowed without corresponding use impairment.

Knott-Floyd County

In 1983, a major outbreak of hepatitis-A occurred throughout Knott county and in scattered portions of Floyd county. Over 146 cases were documented with 50 percent of the victims infected between July and August.

Contaminated drinking water supplies were considered the suspected carrier. A common contamination source was ruled out since the cases were geographically widespread and most of the victims were on private (and separate) water supply systems. When 50 out of the 146 cases were sampled, it was discovered that only 10 of the victims obtained their drinking water from community supplies, 30 had drilled wells, three received their water from springs, three from streams, three from coalbanks, and one from other sources. A large number of private wells were also contaminated with fecal and total coliform. Twenty out of twenty-six wells had total coliform levels greater than the allowable state standards while four out of fifteen wells exceeded the standard for fecal coliform.

Due to the diversity of the water supply and geographic distribution, the exact cause of the outbreak was not pinpointed. However, at least part of the transmission was suspected to result from the improper disposal of human wastes (via pit toilets, faulty septic tanks and drain fields) and subsequent migration into streams and groundwater. A countywide "Boil Water Order" was imposed but since it could not be enforced, its effect on reducing the number of outbreaks could not be determined. Fortunately, the number of outbreaks have since diminished to pre-epidemic levels.

Meade County

From December 1982 through March 1983, a hepatitis-A outbreak occurred in the county resulting in one fatality and over 110 victims. Dye trace studies indicated that underground caverns which flowed to Buttermilk Falls Spring, a local source of drinking water, were flushed of contaminants during high rainfall events. Speculation as to the source of the virus includes local landfills and septic tank discharge from the deceased

victim's home and other area residences (fecal coliform levels were also above standards in some cases). Basically, the outbreaks occurred in rural areas where sewage disposal practices are inadequate and municipal (or treated) water supplies are unavailable.

Naturally high levels of flouride have also been detected in the Meade County communities of Flaherty (1.8 mg/l) and Ekron (1.4 mg/l). Both levels are below the state standards and except for some incidents of slightly mottled teeth, no health problems have been reported. Although water quality will be periodically monitored, no further activity is expected by appropriate local and state agencies unless fluoride levels increase.

Eastern Coalfield

Over the past few years, both the water quality and quantity has significantly changed throughout the Eastern Coalfield region. According to a local water well driller, the water table in this area has definitely dropped over the past ten years (some places averaging up to one foot per year) due primarily to mining activities, and to a lesser degree to decreasing precipitation and structural shifting resulting from earth tremors. Many shallow area wells (60-80') are contaminated with fecal coliform, high iron concentrations and "blackwater". Some of the recent pollution incidents are probably due to the greater level of detection resulting from increased and comprehensive water quality monitoring. While many of these contaminated wells are old wells that need to be re-cased, most contamination results from faulty private septic systems and/or recent mining activities such as blasting or deep mine "robbing." In particular, both the surface and groundwater quality is considered extremely poor in the Evarts, Cranks Creek and Black Mountain areas where mining is heaviest. As a result of these conditions and, pollution-depletion incidents, area wells are reportedly drilled much deeper to reach higher quality water aquifers.

In October of 1982, Governor Brown declared a state of emergency in Harlan County due to an extreme water shortage and water contamination in the Cloverfork area. Officials from the State Human Resources Cabinet reported that more than 30 wells in this area had been identified as dry or the water determined to be "unfit for human consumption." The alleged source of this contamination is from nearby coal mining activities (blasting). The Kentucky National Guard began providing drinking water for the families involved.

Technical Problems In Groundwater Management

The growing groundwater contamination and depletion problem in Kentucky is a major concern of many state environmental agencies. This issue is especially poignant in light of fiscal austerity measures which make it difficult, if not impossible to hire qualified people and fund new groundwater monitoring and management programs. While state agencies have maintained some site-specific groundwater data related to those areas that the state is regulating, detailed and comprehensive knowledge of groundwater occurrence, distribution, reserves, use and recharge is limited. A few of the difficulties in delineating Kentucky's aquifer system, which is an essential first step in groundwater management, are listed along with some potential UIC-specific concerns:

- Lack of Data: Oil and gas well records generally constitute the only deep hole data in Kentucky. Unfortunately drillers logs are not detailed for the more shallow units encountered and, although law requires the reporting of fresh water, its occurrence is not accurately determined during the drilling process. In KGS special publication 10, Series XI, (Geologic Cross Sections and Columnar Sections for Kentucky) it was necessary to have multicounty cross sections because sufficient geologic information was not available for more detailed work.

- Freshwater Occurrence below Saline Water: In many counties well records indicate that fresh water may be encountered beneath saline water. This occurrence has been reported in McCreary, Whitely, Russell, Lawrence, Greenup, Estill, Lee, Jackson, Owsley, Laurel, Knox, Clay and Leslie counties. As an example, KGS Information Circular 12, Series X, reports fresh water at 1100 ft in the New Cypress Oil Pool.

- Fault Zones: Little documented information is available on the influence of fault zones on the distribution of fresh and saline waters. In some instances faults are thought to transmit fresh water to depth but other cases point to an upwelling of saline waters along fault zones.

- Karst Topography: The presence of limestone in more than 50 percent of the state, such as the Mississippian Plateau and Blue Grass provinces, creates irregular groundwater movement in karst (sinkhole) terrain. Little is known about fresh water balances much less the nature of saline water movement from depth.

- Mountain Topography: Steep elevations in eastern Kentucky restrict the spatial distribution of regional aquifers.

- Aquifer Interconnections: Exploratory oil and gas drilling and production since the turn of the century has interconnected aquifer systems in the state's oil and gas fields. Unfortunately, drilling records are few and incomplete.

- Chemical Reactions: Nothing is known about the chemical reaction between injected waste and water residing in the injection zones.

- Radius of Influence: Little is known about the radius of influence a particular injection well might have because little data is available on the hydraulic properties of aquifers that have the potential to be used as an injection zone.

WETLANDS

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The importance of these lands is just being fully understood. Their value lies in several aspects, which when taken either partially or as a whole, often exceeds the apparent economic value of the land itself. Wetlands are among the most productive of all ecosystems. They are vital for the existence of many species of fish, wildlife, and plants. A summary of primary values includes: (1) natural moderation of floods, (2) erosion control, (3) water quality enhancement, (4) groundwater recharge, (5) fish and wildlife habitat, (6) recreation, (7) education and scientific research, (8) aesthetic and open space and (9) food and fiber productivity.

Little research has been conducted on Kentucky wetlands. The Commonwealth's first estimates of wetland acreage came in the early 1950's. This work by the U. S. Fish and Wildlife Service was not field checked and its purpose was limited to locating waterfowl habitat (as specified from U. S. Fish and Wildlife's Circular 39). Using aerial photos, they estimated a total of 273,000 acres were wetland in Kentucky. In 1977, the Ohio River Basin Commission (ORBC), Fish and Wildlife Work Group, in cooperation with the Kentucky Department of Fish and Wildlife Resources, released a report on wetlands along the Ohio River and its tributaries in Kentucky. Their work, which was field checked, revealed 73,000 remaining wetland acres for this area. In 1983, the U. S. Fish and Wildlife Service, in cooperation with the University of Louisville, mapped 113,370 wetland acres along the Green and Tradewater rivers (both tributaries to the Ohio River) in the western Kentucky coalfield. This increase in wetland acreage is most likely due to professional judgement of what constitutes a wetland and differing methodologies. The ORBC study apparently failed to list many of the smaller (under 1000 acres) wetlands and riparian zones mapped by U. S. Fish and Wildlife.

The U. S. Fish and Wildlife Service (1979) documented wetland losses along the Mississippi Alluvial Plain. Kentucky has four counties in the Mississippi Valley which in 1957 accounted for 54,000 acres of wetlands. According to the report, by 1977 the total wetlands of these counties dropped to 34,000 acres, a 37 percent reduction in 20 years. Of the estimated 273,000 wetland acres in Kentucky, in the early 1950's, only 147,370 acres (54%) remain along the Ohio and Mississippi rivers and their tributaries.

There has been no extensive inventory on a statewide basis of Kentucky wetlands. From the limited sources mentioned above, wetlands in Kentucky can be very generally classed into the following categories by utilizing the most recent (1979) U. S. Fish and Wildlife Service classification system.

The majority of Kentucky's wetlands fall into the Palustrine System. Areas lying shoreward of rivers and lakes, including floodplains, oxbows, ponds, marshes, and swamps, are members of this category. The broad alluvial floodplains of the Ohio and Mississippi rivers and their tributaries in western Kentucky comprise the vast majority of Kentucky wetlands. Small ponds are common throughout the state and their area is difficult to assess. They are, however, very important and have value as ecological epicenters. The Riverine System includes all wetlands and deepwater habitats contained within a channel that experiences continuous or periodic moving water or connects two bodies of standing water. While wetlands of this type are not extensive, they do provide unique habitat for many rare or endangered species and are very important ecologically. Lacustrine Systems in Kentucky are limited to man-made lakes, their shorelines, and spillways. The Lacustrine Systems are the least ecologically significant of the Kentucky wetlands.

The major threat to Kentucky wetlands is their destruction due to competing land use activities and poor land management practices. Both coal mining and agricultural practices are depleting this unique habitat. Strip mining operations in the western Kentucky coalfield are either totally destroying, by actually stripping coal from wetland areas, or drastically altering, by siltation and acid mine drainage, much of Kentucky's wetlands. The 1983 U. S. Fish and Wildlife Service study in the western Kentucky coalfield, determined that 515 stream miles were affected by acid mine drainage. Problem parameters degrading water quality included manganese, sulfate, aluminum, conductivity, turbidity, dissolved oxygen, pH, and iron. They concluded that nearly all of the wetlands in the coalfield have been adversely impacted by coal mining practices.

Logging and agricultural practices such as channelizing, tile draining, burning, and otherwise altering the water regime to render the land tillable are rapidly depleting wetland ecosystems. Other agricultural practices which cause erosion and chemical fertilizer and pesticide runoff, are also having adverse effects on the natural system.

To a lesser extent and generally in localized situations, domestic and industrial sewage discharge, oil brine discharge, and urbanization are having detrimental effects on Kentucky wetlands.

At the present time there is no monitoring program for Kentucky wetlands. A monitoring program is needed and would be an invaluable tool toward good wetland management. To initiate a monitoring program, an intensive survey and classification of Kentucky's wetlands is needed. The survey would yield considerable useful quantitative and qualitative baseline data. From this data, continual ambient monitoring of strategic wetland areas could be established to show losses of wetland acreage and trends in chemical and biological parameters. Knowledge of these parametric trends could then be used to make sound managerial decisions. Other needs of Kentucky wetlands are an increased public awareness of the value of these ecosystems; acquisition and protection of strategic wetlands; and regulations requiring permits and mitigation funds for altering wetland systems.

CHAPTER II

SPECIAL CONCERNS / REMAINING PROBLEMS

OIL AND GAS PRODUCTION POLLUTION

Oil and/or gas is produced in sixty-three Kentucky counties, but most production occurs in only a few counties. A cluster of eight counties in western Kentucky accounts for almost 65 percent of the state's oil production. Seven counties in eastern Kentucky account for another 26 percent. Natural gas is produced in thirty-one of Kentucky's counties, but eight counties produce about 90 percent of the total. Approximately 97 percent of the state's natural gas production occurs in eastern Kentucky.

In 1981, Kentucky's crude oil production was about 17,900 barrels per day which represented about 0.21 percent of the nation's total production. Production of natural gas in Kentucky was about sixty-three billion cubic feet in 1981, or 0.33 percent of the national output. The number of wells (oil, gas, dry, and service) drilled in Kentucky in 1981 was 1,780. This number represented approximately 2.2 percent of the wells drilled in the United States during 1981.

The Cabinet has defined the area of direct impact from produced water discharges to surface waters to include the Licking River Basin, the Upper Cumberland River Basin, the Kentucky River Basin, the Green River Basin and the Big Sandy River Basin. The entire population of Kentucky is indirectly affected by the adverse impacts on the natural resources of the Commonwealth. These resources include stream quality, aquatic habitats, national forest areas, and the productive capabilities of land.

The Cabinet has received numerous reports concerning detrimental effects on the environment and adverse impacts on the citizens of Kentucky as a result of the improper disposal of produced water. These reports, along with expressions of concern about the problem, have been generated by wildlife and environmental agencies as well as the private sector. The following are several examples of incidents and concerns:

- In January 1982, the Secretary of the Cabinet received a letter from the Kentucky Department of Fish and Wildlife Resources concerning a pollution problem in the South Fork of the Red River in Powell County. The letter and supporting materials documented the severe impact on the aquatic resources of the South Fork due to brine water discharge. In addition, the letter stated an opinion that impacts will continue downstream and eventually affect the biota in the main stem of the Red River.

- The National Forest Service has contacted the Cabinet concerning pollution problems encountered in forests within Kentucky due to brine discharge.

- The Kentucky Nature Preserves Commission has expressed concern over the damaging effects of brine on plant and aquatic life.

- During the fall of 1982, high sodium levels were detected in the water supplies for the towns of Clay City and Stanton. An alert was issued for persons on sodium restricted diets.

- In January, 1982, the Lexington Fayette Urban County Board of Health adopted a resolution requesting that the Cabinet and the U.S. Environmental Protection Agency take immediate steps to determine the

extent of saline and bromide contamination in the Kentucky River and its tributaries.

- In November, 1982, a public hearing was held in Magoffin County to address the problem of private well contamination. Approximately fifty concerned citizens attended. The complaints included oil and brine in well water, livestock refusing to drink, and clothes washed in well water turning brown. Later that month, Governor Brown signed Executive Order 82-995 declaring a state of emergency in Magoffin County due to the contamination of private wells by oil and brine. The Executive Order authorized the National Guard to deliver water to affected residents of the county. In addition, the Governor directed the Cabinet to develop a regulatory program for protection of the surface and subsurface waters of the Commonwealth from improper brine disposal and the Division of Disaster and Emergency Services to identify alternative sources of potable water.

The Cabinet has received additional complaints of this nature from citizens in other regions of the Commonwealth.

In January of 1984 Kentucky adopted a new regulation 401 KAR 5:090 entitled Control of Water Pollution From Oil and Gas Facilities which provides for preventing, abating, and controlling water pollution from the subject facilities. In addition, the Cabinet funded a study initiated by the University of Kentucky, School of Biological Sciences in August 1983 for the purpose of developing numerical criteria associated with Kentucky's aquatic life use classification, which may be influenced by wastewater discharges from oil and gas production activities in the state. Recommended criteria will be incorporated into Kentucky's water quality standards regulations as a component of the 1984 triennial review process.

ACID MINE DRAINAGE

The 1982 Water Quality Report to Congress devoted a special section to the problem of acid mine drainage (AMD) in Kentucky. That section pointed out that the western coalfield had the most serious problems with AMD. The Tradewater River basin and the Green River basin were the most seriously affected basins in the state. Scattered streams were also affected in the eastern coalfields but not nearly to the extent as in the western coalfields.

The status of acid mine drainage impacts on the streams of Kentucky has remained essentially unchanged over the past two years. It will remain a continuing concern because most of the drainage comes from abandoned mine lands. The state has a program to reclaim abandoned mine lands but the priority for reclamation is to first address those sites which pose an extreme danger to public health, safety, general welfare or property because of past coal mining practices. Environmental effects, such as stream water quality and aquatic habitat degradation, are considered a lower priority. When priority one sites are reclaimed, there is the possibility that reclamation funds can be used to address stream water quality. An assessment of stream improvements will be made at that time.

CONSTRUCTION GRANTS FUNDING

A recent update of financial information for Construction Grants applicants shown on Kentucky's priority list indicates a total of $1.1 billion in wastewater needs. This figure is overwhelming in comparison with Kentucky's annual construction grants allotment of $31.1 million.

In an attempt to spread available dollars over more projects, the federal funding level has been reduced to 55 percent effective October 1, 1984. Many dollars may still be obligated over the next several years at the 75 percent level due to the fact that multi-year projects initiated before October 1, 1984 can receive 75 percent funding until a project is completed. Kentucky will give serious consideration to requesting that EPA change policy so that multi-year projects are funded at 55 percent after October 1, 1984. This will allow segmented projects to be funded for the 20 year design, while the funding is maintained at 55 percent.

Many of the smaller communities in line to receive funding at the 55% level will have extreme difficulty developing the required local share. Communities with a large customer base will have less difficulty and will be in a better position to take 55 percent funding not used by smaller communities.

POLLUTION-CAUSED FISH KILLS

Fish kills are investigated by the Kentucky Department of Fish and Wildlife Resources and reported to the Division of Water.

During 1982, 27 kills attributed to pollution were reported (see Table 21). Approximately 52 miles of stream were affected resulting in an estimated kill of 98,436 fish. Of the reports containing counts of dead fish, four were light (less than 100), eight were moderate (100-1000), and five were major (more than 1000). Mining or oil drilling operations were responsible for six kills, agricultural wastes for eight kills, oil or chemical spills for seven kills and wastewater for three kills. The causes of the additional three kills were undetermined. The largest kill was caused by release of zinc cyanide from a plating operation which affected approximately 15 miles of North Elkhorn Creek in Fayette and Scott counties.

During 1983, 37 kills attributed to pollution were reported. Approximately 51 miles of stream were affected resulting in an estimated kill of 76,187 fish. Of the reports containing counts of dead fish, two were light, four were moderate, and nine were major. The causes of the kills were varied. Oil or chemical spills (14), wastes from oil drilling or mining operations (7), and wastewater (7) were the most frequent. The largest kill was caused by wastes from a hog feeding operation.

Additional information on fish kills is contained in Appendix D.

Table 21

Fish Kill Summary

		1982	1983
Severity:	Light (<100)	4	2
	Moderate (100-1,000)	8	4
	Major (>1,000)	5	9
	Unknown	10	22
	TOTAL	27	37
Cause:	Mining or Oil operation	6	7
	Agricultural operation	8	5
	Oil or Chemical spill	7	14
	Wastewater	3	7
	Unknown	3	4
	TOTAL	27	37
River Basin:	Big Sandy	2	3
	Little Sandy	0	0
	Tygarts Creek	0	0
	Licking	4	5
	Kentucky	8	13
	Salt	4	4
	Green	2	5
	Tradewater	0	0
	Upper Cumberland	4	4
	Lower Cumberland	0	0
	Tennessee	0	1
	Ohio	3	1
	Mississippi	0	1
	TOTAL	27	37
Approximate Number of Stream Miles Affected		52	51
Estimated Number of Fish Killed		98,000	76,000

CHAPTER III

WATER POLLUTION CONTROL PROGRAMS

POINT SOURCE CONTROL PROGRAM

From January 1, 1982 to September 30, 1983 Kentucky's point source permitting program (NPDES) was administered by EPA, Region IV in Atlanta, Georgia. EPA's efforts were directed towards issuing permits for major industrial and major municipal dischargers as a first priority, with minor industrial and minor municipal facilities issued as time allowed. Nearly all industrial permits contained technology-based limits (BPT/BAT) whether the discharges were into effluent-limited or water quality-limited streams. Major and minor municipal permits specified secondary treatment for discharges into effluent limited streams with stricter limits for most water quality-limited streams. During this period of time the state's Division of Water was reviewing these permits and certifying their adequacy with regard to Kentucky Water Quality Standards pursuant to Section 401 of the Clean Water Act.

Effective October 1, 1983, EPA delegated the responsiblity of NPDES to the state and the Division of Water began issuing Kentucky Pollutant Discharge Elimination System (KPDES) permits. The Division of Water inherited a backlog of nearly 1700 expired or unissued permits from EPA. A large portion of that backlog consists of minor coal mining facilities (also regulated by the state's Department for Surface Mining Reclamation and Enforcement, DSMRE). During the first quarter of 1984 the Division of Water issued a statewide General Permit for Coal Mining Discharges that will soon remove nearly two-thirds of the existing backlog. General Permit coverage is keyed to DSMRE identification numbers which enables DSMRE inspectors to determine KPDES compliance during their routine surveillance activities. For 106/305(b) reporting purposes, the Division of Water will periodically receive summaries of DSMRE compliance/enforcement activities for facilities covered by the General Permit.

Figure 10 shows how KPDES applications are processed into final discharge permits. The process by which effluent limits are generated based on water quality standards and effluent guidelines is diagramed in Figure 11.

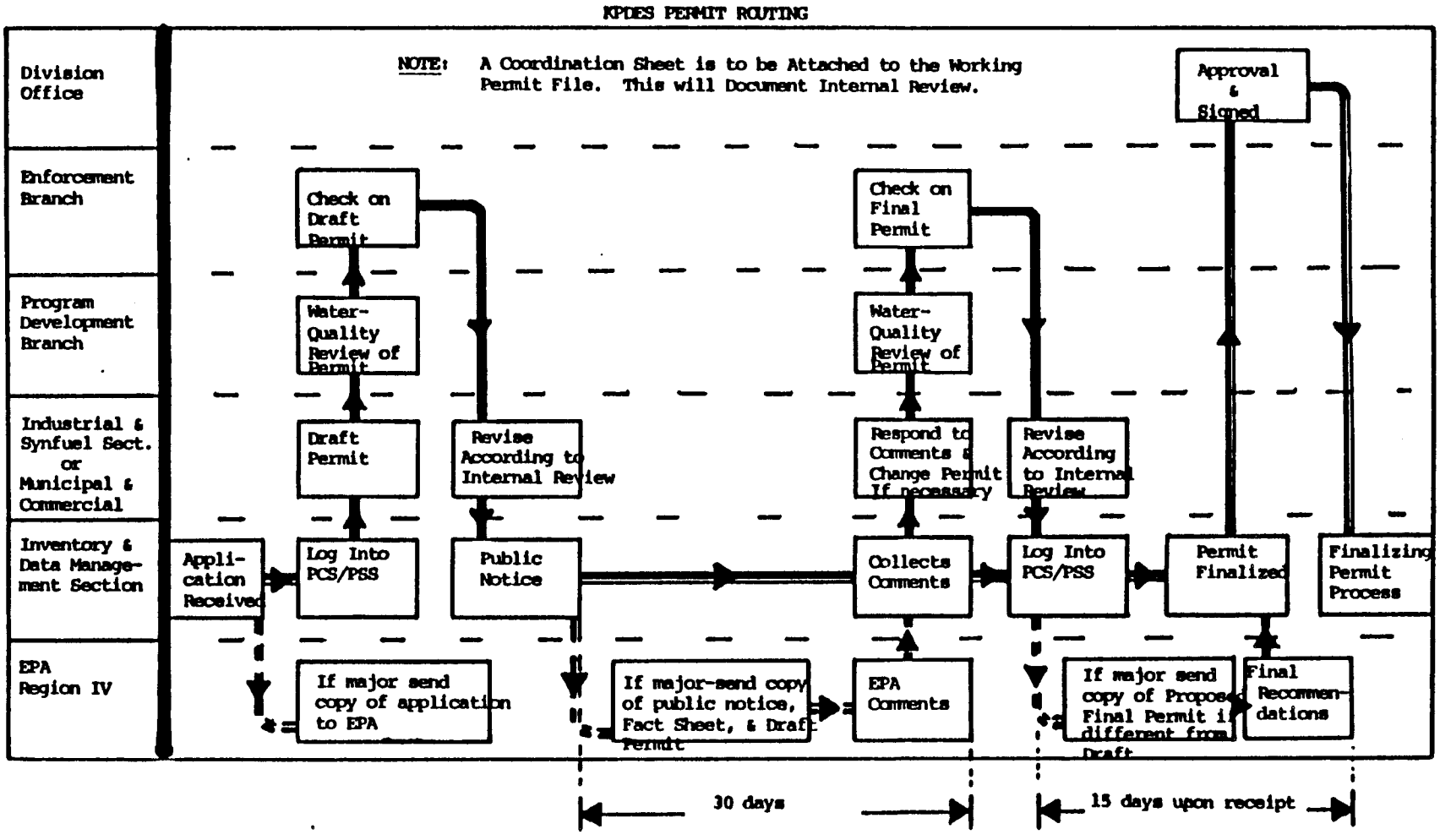
Municipal Facilities

The Construction Grants Program is reponsible for managing federal grants awarded to municipalities for the construction of sewage treatment plants. Kentucky has been delegated fourteen of the twenty functions required for primary responsibility to administer the program.

The Construction Grants Program has resulted in the construction of $183 million in wastewater projects which came on line during 1982-1983. The result has been the completion of 30 wastewater projects. In addition, 39 projects are in various stages of construction. Table 22 provides a listing of projects which have been completed. These projects are located on the state map presented in figure 12. Table 23 contains a listing of projects which have been funded but are not yet completed.

A review of the discharge monitoring reports for the facilities completed during calendar year 1982 and 1983, which previously had wastewater discharges to surface waters, indicates the following:

Figure 10


KPDES PERMIT ROUTING
Division Office
Enforcement Branch
Program Development Branch
Industrial & Synfuel Sect. or Municipal & Commercial
Inventory & Data Management Section
EPA Region IV
NOTE: A Coordination Sheet is to be Attached to the Working Permit File. This will Document Internal Review.
Approval & Signed
Check on Draft Permit
Water-Quality Review of Permit
Draft Permit
Revise According to Internal Review
Check on Final Permit
Water-Quality Review of Permit
Respond to Comments & Change Permit If necessary
Revise According to Internal Review
Appli-cation Received
Log Into PCS/PSS
Public Notice
Collects Comments
Log Into PCS/PSS
Permit Finalized
Finalizing Permit Process
If major send copy of application to EPA
If major-send copy of public notice, Fact Sheet, & Draft Permit
EPA Comments
If major send copy of Proposed Final Permit if different from Draft
Final Recommen-dations
30 days
15 days upon receipt

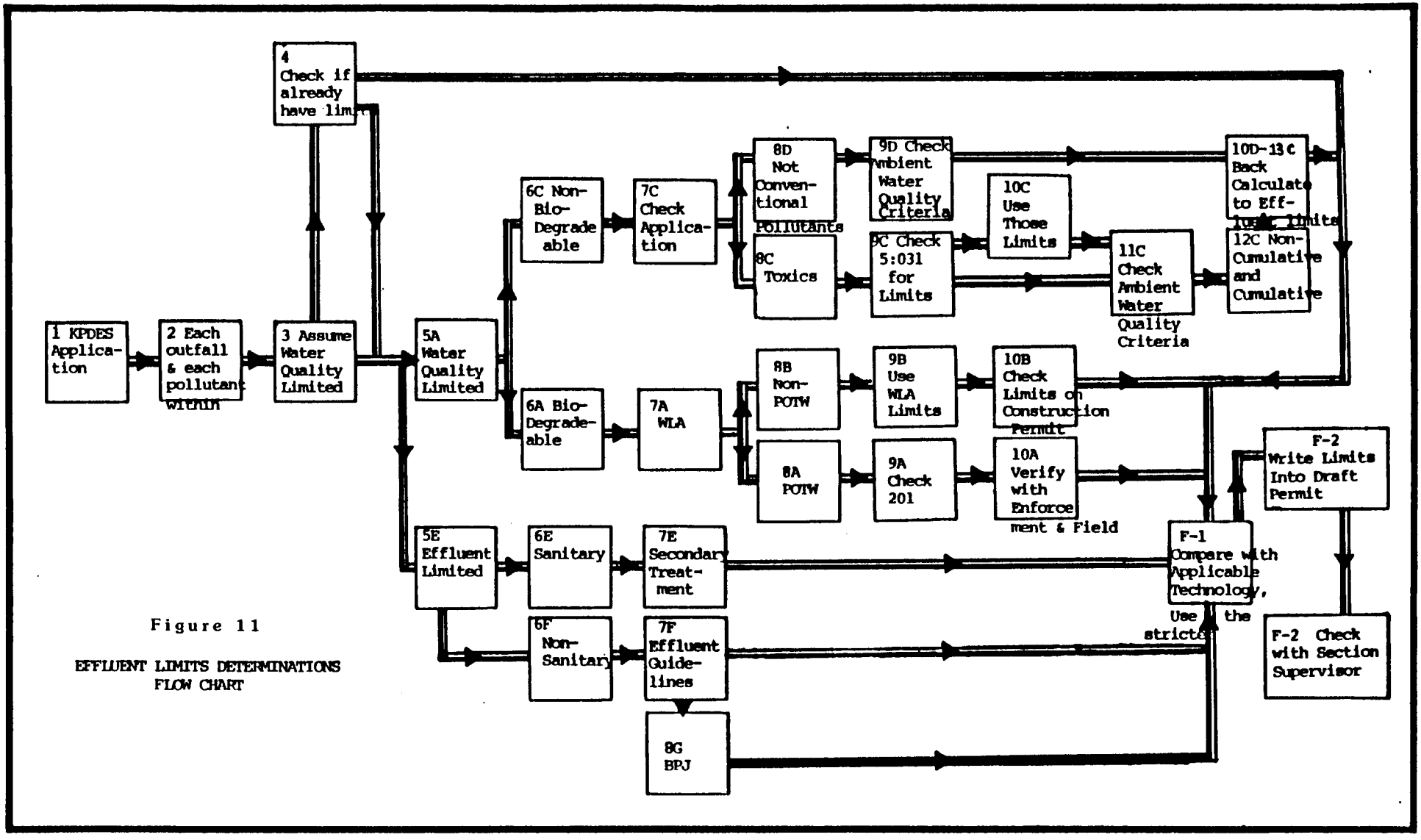


Figure 11

EFFLUENT LIMITS DETERMINATIONS
FLOW CHART

Table 22

Construction Grants Funded Projects Which Came On Line During Calendar Years 1982 and 1983

Project	Date on Line	Design Flow (mgd)	Treatment Cost* (Million Dollars)	Other Costs* (Million Dollars)
Ashland	June 1982	11.000	14.000	2.600
Bedford	Feb. 1983	0.114	0.283	1.184
Bowling Green	Nov. 1982	8.400		3.622
Caneyville	June 1983	0.110	0.482	0.983
Corbin	Apr. 1982	4.500	3.253	0.545
Crab Orchard	Jan. 1983	0.110	0.745	1.183
Crofton	Apr. 1982	0.066	1.227	0.577
Drakesboro	July 1983	0.100	0.951	0.819
Fancy Farm	Apr. 1982	0.140	0.494	0.728
Fordsville	Dec. 1983	0.110	0.974	0.705
Grnup. Env. Com.	Sept. 1982	2.050	3.970	1.140
Guthrie	Sept. 1982	0.310	1.975	1.032
Harrodsburg	Nov. 1982	2.680	8.931	0.338
Hopkinsville S	Sept. 1983	5.300	20.317	7.235
Hopkinsville N	Apr. 1982	2.880	6.178	
Jamestown	May 1982	2.500	2.642	1.951
Livermore	Apr. 1982	0.350	1.821	0.725
London	June 1982	4.000	6.793	1.357
Madisonville	June 1983	4.500	8.769	13.388
Morehead	1982	2.500	5.810	4.000
Mt. Sterling	1982	2.660	4.900	0.590
Nicholasville	May 1983	2.800	7.261	4.271
Nortonville	June 1982	0.140	1.450	0.781
Richmond (TC)	July 1983	3.750	8.765	0.964
Richmond (DC)	Sept. 1983	4.500	8.422	0.926
Salem	Dec. 1983	0.100	1.267	0.682
Shepherdsville	Feb. 1983	1.000	3.922	1.617
Simpsonville	Dec. 1982	0.120	0.357	1.182
West Point	June 1983	0.300	0.352	
Williamstown	Apr. 1982	0.533	0.836	0.802
TOTAL		67.623	127.147	55.927

*Costs shown include local share.

Figure 12

KENTUCKY MUNICIPAL CONSTRUCTION GRANTS

PROJECTS COMPLETED IN 1982-1983

1	Ashland	16	Jamestown
2	Bedford	17	Livermore
3	Bowling Green	18	London
4	Caneyville	19	Madisonville
5	Corbin	20	Mt. Sterling
6	Crab Orchard	21	Morehead
7	Croftin	22	Nicholasville
8	Drakesboro	23	Nortonville
9	Fancy Farm	24	Richmond (TC)
10	Fordsville	25	Richmond (DC)
11	Greenup	26	Salem
12	Guthrie	27	Shepherdsville
13	Harrodsburg	28	Simpsonville
14	Hopkinsville (North)	29	West Point
15	Hopkinsville (South)	30	Williamstown

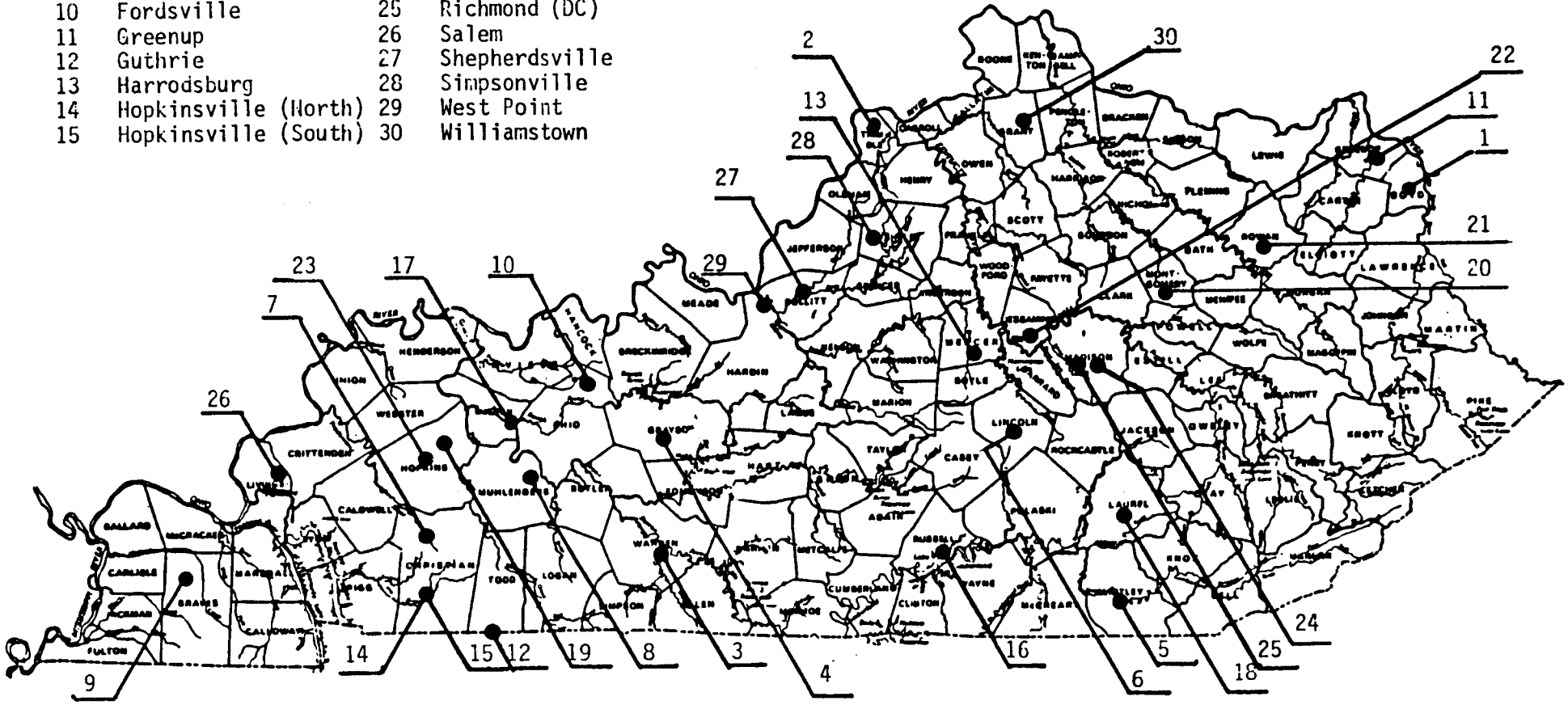


Table 23

Projects Which Have Received Construction Grants Funding But Construction Is Not Yet Completed

Project	*Type Grant	Total Cost
Alton W.D.	2/3	1,803,900
Berea	2/3	7,507,471
Berry	2/3	888,400
Bradfordsville	2/3	574,920
Carrollton	2/3	3,818,248
Centertown	2/3	1,197,875
Elizabethtown	3	17,576,675
Fleming-Neon	3	7,065,004
Flemingsburg	2/3	5,135,990
Fountain Run	2/3	657,050
Franklin	2/3	5,491,029
Georgetown	3	6,294,963
Hardinsburg	2/3	2,018,292
Hickman	2/3	870,650
Inez	2/3	3,736,776
Irvington	2/3	2,335,914
Island	2/3	1,143,548
LaCenter	2/3	556,686
LaGrange	2/3	3,180,423
Lexington - West Hickman	3	28,782,426
Midway	2/3	2,466,394
Milton	2/3	1,033,633
Monticello	2/3	5,770,694
Mt. Vernon	2/3	1,201,780
New Castle	2/3	1,583,700
Owensboro	3	8,492,722
Paintsville	2/3	3,137,668
Princeton	3	4,910,310
Radcliff	2/3	5,289,212
Russellville	3	2,143,185
Sacramento	2/3	1,612,919
Sadieville	2/3	952,600
SD #1 Shelby Co.	2/3	3,500,000
Scottsville	2/3	2,464,446
Shelbyville	3	4,322,137
Springfield	2/3	2,303,230
Stanford	2/3	1,688,545
Stanton	2/3	1,342,255
Sturgis	2/3	2,217,417

*3 Means Construction Funding
2/3 Means Design and Construction Funding

	Previous Discharge lbs/yr.	Existing Discharge lbs/yr.	Improvement lbs/yr.
BOD	5,254,694	748,645	4,506,049
TSS	3,623,068	899,478	2,723,590

Note: BOD is 5 day biochemical oxygen demand, TSS is total suspended solids.

Although significant improvements in water quality have been realized through the construction of the new wastewater treatment facilities, there are numerous needs that remain to be addressed. The 1982 Needs Survey indicated that the problems associated with the following categories of municipal discharges need to be resolved:

- o Municipal discharges causing water quality problems,
- o Municipal discharges that are causing public health hazards, and
- o Municipal discharges that do not meet minimum federal requirements.

The 1982 Needs Survey indicated that Kentucky has in excess of $835 million in wastewater treatment projects that remain to be built. Since most of these needs are based on water quality-based KPDES permit limitations, this would indicate that significant water quality problems exist in the state due to inadequately treated point sources. Additionally, in the areas of combined sewer overflow and stormwater system needs, this survey indicated that the state has in excess of $1,450 and $2,340 million, respectively, to correct these problems. These needs are overwhelming when compared to the $31.1 million in federal assistance currently allocated to Kentucky for wastewater treatment projects.

In order to continue to target federal assistance toward the most serious water quality problems, Kentucky is reviewing its Construction Grants Projects Priority List and Formula to assure that water quality and public health projects receive proper prioritization. New formula factors being added for 1985 will be reviewed at a public hearing to assure consistency in allocating projects according to their priority.

Industrial Facilities

On the subject of water quality benefits from technology-based effluent limits, the imposition of BPT/BAT-level permit limits should not have a noticeable effect on water quality because these limits are only used for effluent-limited streams. For water quality-limited streams, no data is currently available to show improvements that resulted from water quality-based permit limits due to the minimal use of these limits on industrial dischargers during 1982-1983. It is anticipated that the use of water quality-based limits on dissolved solids for oil stripper well brine discharges will lead to significant improvements in a large number of small streams in the south-central and south-eastern regions of the state.

Permit Compliance

During Federal Fiscal Year 1983 the Kentucky Division of Water began to take a stronger stand regarding enforcement. A new "Notice of Violation" was developed and a plan implemented to bring about a quicker resolution to water pollution problems. The new plan provides a more effective legal approach for bringing facilities into compliance with their permits. With the aid of data processing equipment, violations are detected sooner on self-monitoring data and enforcement action is much more

timely and effective than in previous years. In late 1983, the Division began preparing a quarterly non-compliance report on all major facilities to better track these facilities and immediately address non-compliance. The Division intends to expand this procedure to the minor municipal category in Federal Fiscal Year 1985. A new "State Municipal Strategy" was developed in early 1984 that lays the groundwork to bring all municipal facilities in the state into compliance by 1988. Implementation of this strategy will begin in June of 1984.

Enforcement

The procedure generally followed to enforce compliance with Water Quality Regulations involves identification of problem violations through on-site inspection and evaluation of self-monitoring data, informal negotiations resulting in legally enforceable compliance schedules, and civil litigation before an administative hearing officer. Most violations are resolved through informal negotiations by the Division of Water's field personnel. More severe or persistent violations are usually addressed by legally enforceable Agreed Orders negotiated by the Division's central office. When informal negotiations fail to achieve compliance, the Natural Resources and Environmental Protection Cabinet has the authority to conduct formal administrative hearings and employs a staff of attorneys for that purpose. After formal hearings, the Cabinet Secretary may execute compliance orders and assess civil penalties. It is also possible to obtain immediate relief through Franklin Circuit Court by seeking a restraining order or injunction.

During Federal Fiscal Years 1982 and 1983, enforcement activities resulted in 86 legally enforceable compliance orders and the assessment of $113,000 in civil penalties. While it is presumed that improvements in stream quality result from these activities, the Division has rarely been able to allocate the resources necessary to document improvements.